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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|--------------------------------|-------------|----------------------|---------------------|------------------|
| 10/646,157 | 08/22/2003 | Rajiv Singh | 5853-388 | 9591 |
| 30448 | 7590 | 02/24/2006 | EXAMINER | |
| AKERMAN SENTERFITT | | | WEBB, GREGORY E | |
| P.O. BOX 3188 | | | ART UNIT | |
| WEST PALM BEACH, FL 33402-3188 | | | PAPER NUMBER | |
| | | | 1751 | |

DATE MAILED: 02/24/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|-------------------------------------|--|
| Office Action Summary | Application No. 10/646,157 | Applicant(s) SINGH, RAJIV | |
| | Examiner Gregory E. Webb | Art Unit 1751 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 December 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9 and 11-20 is/are pending in the application.
- 4a) Of the above claim(s) 12-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 and 11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>121503</u> . | 6) <input type="checkbox"/> Other: _____ |

[Signature]
2/2/06

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DETAILED ACTION

Claim Objections

Claim 1 is objected to because of the following informalities:

Several phrases in claim 1 were not completely clear to the examiner. First, the applicant uses the phrase "at one halide." The examiner will assume this phrase to mean "at least one halide."

Second, the applicant does not use the subscript to define the diatomic chlorine in line 5.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The applicant's amended claims are now directed at a liquid composition which comprises a halide ion and a diatomic halogen molecule.

Claims 1-9, and 11 rejected under 35 U.S.C. 102(b) as being anticipated by Pyo (US6593236).

Concerning the chemical mechanical polishing and the polishing slurry, Pyo teaches the following:

completely filling the damascene pattern by a copper electroplating method
and forming a copper metal wiring by performing a hydrogen reduction
annealing process and a chemical mechanical polishing process.(see col. 1, lines 48-61)

Concerning the halogen ion and the iodine ion, Pyo teaches the following:

7. The method of claim 1, wherein the chemical enhancer layer has a
thickness ranging from about 50 to about 500 .ANG. and is formed with a

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catalyst selected from the group consisting of I (iodine)-containing liquid compound, $\text{Hhfac}_{1/2}\text{H}_{.2}\text{O}$, Hhfac, TMVS, pure $\text{I}_{.2}$, and I (iodine)-containing gas with water vapor at a temperature ranging from about -20 to about 300.degree. C. for a time period ranging from about 1 to about 600 seconds.(see claim 7)

Concerning the diatomic halogen, Pyo teaches the following:

8. The method of claim 7, wherein the I (iodine)-containing liquid compound is selected from the group consisting of $\text{CH}_{.3}\text{I}$, $\text{C}_{.2}\text{H}_{.5}\text{I}$, $\text{CD}_{.3}\text{I}$ and $\text{CH}_{.2}\text{I}_{.2}$.(see claim 8)

Concerning the copper layer, Pyo teaches the following:

Referring now to FIG. 1D, the chemical enhancer layer 16 has risen to the surface of the CECVD copper layer 17a and is removed by means of plasma process while the CECVD copper layer 17a is deposited. The exposed CECVD copper layer 17a may have indentations due to the step coverage of the damascene pattern but the indentations can be completely filled by forming a copper plating layer 17b using copper electroplating method.(see col. 3, lines 3-10).

Claims 1-9, and 11 rejected under 35 U.S.C. 102(b) as being anticipated by Aoki (US5676760).

Concerning the chemical mechanical polishing, Aoki teaches the following:

A cathode water having a slow etch-rate range is applicable to removing inorganic particles residual on a silicon substrate. For example, an embodiment applied to removing colloidal silica adhered onto a Si

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substrate which has been subjected to CMP (chemi-mechanical polishing) will be described below. FIG. 6 shows a cleaning effect attained by a ten minute overflowing of a cathode water having -720 mV and 8.2 in ORP and pH values, which has been prepared by electrolysis of an electrolytic solution including ammonium chloride at concentration of 5×10^{-5} mol/l, in comparison with a conventional method using an APM solution. The result indicates that colloidal silica remained at more than 2000 particles/wafer prior to treatment reduced down to 80 particles/wafer. It is an excellent result as compared to the result of 100 particles/wafer which is attained by the conventional APM solution. Hence, employment of cathode water reduced concentration of chemicals and improved operational safety. Cathode waters having ORP values less than -700 mV and pH values more than 8 are especially effective for removing those inorganic particles. Electrolyzed waters obtained from solutions including ammonium chloride or ammonium acetate only at a rate of 2×10^{-5} mol/l have also enough effective. This cathode water treatment is employed to remove particles by a minute amount of etching a silicon surface. Simultaneously, the cathode water exhibited an advantage that particles are difficult of re-adhesion onto the silicon substrate surface in the cathode water.(see cols. 9-10)

Concerning the polishing slurry, Aoki teaches the following:

There exist many so-called wet processing steps for manufacturing

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semiconductor devices, such as cleaning, etching and rinsing. Even if confined to steps conducted by semiconductor substrate manufacturers, after a step for pulling-up single crystals, the wet processes extend to cleaning processes. These include slicing, mechanical lapping and chemi-mechanical polishing steps by employing organic chemicals, a cleaning process for removing sludges generated in the mechanical lapping step, etching processes employing strong acids and alkalis, and chemi-mechanical polishing process; which consumes vast volume of chemicals.(see col. 1, lines 33-45)

Concerning the halogen ion, iodine ion and the bromine ion, Aoki teaches the following:

It is recognized that an electrolysis induces a high oxidizing water on the anode side while a high reducing water on the cathode side. Comparison among three species of electrolytes clarifies that an electrolyte including chlorine ions generates an anode water having a large ORP value while an electrolyte including ammonium produces a cathode water having a small ORP value (a large reducing activity). Besides chlorine, bromine and iodine are recognized to have a similar effect as electrolytes for enlarging ORP values of an anode water. Accordingly, it is advantageous in obtain an anode water having a high oxidizing activity by employing salts such as ammonium chloride as an electrolyte beside hydrochloric acid, bromine solution, iodine solution etc.(see col. 8, lines 10-23)

Concerning the preferred iodide and the salt, Aoki teaches the following:

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On the other hand, it is advantageous to obtain a cathode water having a small ORP value (for instance, -800 mV), namely a large reducing activity, by employing salts such as ammonium chloride, ammonium acetate, ammonium fluoride, ammonium nitrate, ammonium bromide, ammonium iodide, ammonium sulfate, ammonium oxalate, ammonium carbonate, ammonium citrate, ammonium formate etc. as electrolytes besides aqueous ammonia(see col. 7, lines 32-59)

Concerning the chlorine ion, Aoki teaches the following:

There exists an optimum selection of electrolytes for most adequately performing a specified wet processing, although the electrolyzed water obtained by electrolysis of a solution wherein the many electrolytes mentioned above are added operates effectively during various kinds of semiconductor wafer processing. As shown later in some embodiments, an electrolyzed water scarcely containing chlorine ions exhibits a more remarkable effect because a wet processing after dry etching performed in an environment containing chlorine gas is generally directed to eliminating chlorine ions. Accordingly, ammonium acetate etc. as an electrolyte is preferred over of ammonium chloride.(see col. 8, lines 33-45)

Concerning the diatomic halogen, Aoki teaches the following:

5. A method for processing a semiconductor substrate as defined in claim 4, further comprising a fourth step of bubbling said anode water with at least one gas selected from the group consisting of Cl.sub.2, Br.sub.2, I.sub.2 or O.sub.3.(see claim 5)

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Claims 1-9, and 11 rejected under 35 U.S.C. 102(b) as being anticipated by Pyo, Sung Gyu (US20020006727).

Concerning the chemical mechanical polishing and the polishing slurry, Pyo, Sung Gyu teaches the following:

[0009] The disclosed method of forming a metal wiring in a semiconductor device is characterized in that it comprises: providing a substrate in which an interlayer insulating film consisted of first, second and third insulating films are formed on a lower metal layer; forming a damascene pattern consisting of a trench and a via on the interlayer insulating film; forming a diffusion prevention film spacer on the sidewall of the trench and the via; selectively forming a chemical enhancer layer on the second insulating film constituting the bottom of the trench and on the lower metal layer constituting the bottom of the via; forming a copper layer by means of chemical vapor deposition method; and performing a hydrogen reduction annealing and a chemical mechanical polishing process to form a copper metal wiring.

Concerning the halogen ion and the iodine ion, Pyo, Sung Gyu teaches the following:

7. The method of claim 1, wherein the chemical enhancer layers are formed in a thickness ranging from about 50 to about 500 .ANG., using a catalyst, selected from the group consisting of I (iodine)-containing

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liquid compound, $\text{Hhfac}1/2 \text{H.sub.2O}$, Hhfac , TMVS , pure I.sub.2 , I (iodine)-containing gas, and water vapor at a temperature ranging from about -20 to about $300.\text{degree. C.}$ for a time period ranging from about 1 to about 600 seconds.

Concerning the diatomic halogen, Pyo, Sung Gyu teaches the following:

8. The method of claim 7, wherein the catalyst is an I (iodine)-containing liquid compound selected from the group consisting of CH.sub.3I , C.sub.2H.sub.5I , CD.sub.3I and CH.sub.2I.sub.2 .

Concerning the copper layer, Pyo, Sung Gyu teaches the following:

1. A method of forming a metal wiring in a semiconductor device, the method comprising: providing a substrate with a lower metal layer overlying the substrate and an interlayer insulating film comprising first, second and third insulating films formed on the lower metal layer; forming a damascene pattern comprising a trench and a via on the interlayer insulating film, a portion of the second insulating film forming a bottom of the trench, a portion of the lower metal layer forming a bottom of the via, the trench and the via each comprising a sidewall; forming diffusion prevention film spacers on the sidewalls of the trench and the via; selectively forming chemical enhancer layers on the portion of the second insulating film forming the bottom of the trench and on the portion of the lower metal layer forming the bottom of the via; forming a copper layer on the diffusion prevention film spacer

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and chemical enhancer layers by means of chemical vapor deposition method; and performing a hydrogen reduction annealing and a chemical mechanical polishing process to form a copper metal wiring from the copper layer.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-9, and 11 are rejected under the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-23 of U.S. Patent No. 6,821,309. Although the conflicting claims are not identical, they are not patentably distinct from each other because each of the instant claims and the corresponding claims of the '309 patent require a solution which contains a halogen or halogen salt in combination with a diatomic halogen such as I.sub.2.

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3. As the patented claims describe the solution being claimed, the patented claims render obvious the applicant's claimed invention.

Response to Arguments

4. Applicant's arguments with respect to claims 1-9, and 11 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory E. Webb whose telephone number is 571-272-1325.

The examiner can normally be reached on 9:00-17:30 (m-f).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'G Webb', with a large loop at the end of the 'G'.

Gregory E. Webb
Primary Examiner
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gew